



OREGON MODELING IMPROVEMENT PROGRAM

Oregon Department
of Transportation

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Transportation and Land Use Model Integration Program

HOLISTIC TRAVEL MODELING DRIVES THE OREGON PROGRAM

Federal and state policies and regulations enacted in the 1990s brought new challenges to travel modeling professionals. Policy-makers started looking beyond roads to discuss the entire system, linking land use, transportation and the economy. Analytical tools to facilitate these holistic discussions did not exist.

In 1994, ODOT embarked upon a comprehensive Oregon Modeling Improvement Program (OMIP) to technically support these new federal and state policies and regulations. A significant part of OMIP is the Transportation and Land Use Model Integration Program (TLUMIP) initiated in 1996.

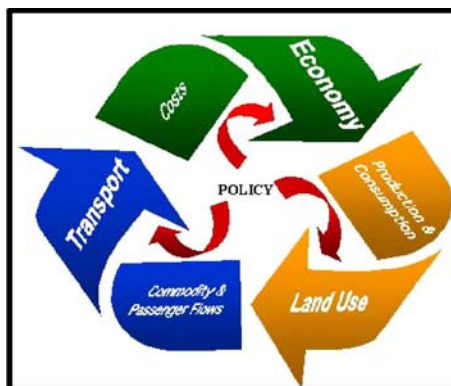
TLUMIP is an integrated transportation, land use and economic model for use in transportation planning and policy analyses at the regional and statewide levels. The first generation of the model, called Oregon1, has now been successfully applied to several complex policy issues. Using information gained from these initial applications, Oregon2 is significantly refining and expanding elements of the program in a state-of-the-art modeling framework. This framework covers Oregon's 36 counties and parts of adjoining states. It operates at various levels of geography, including a 30-meter grid of study area land use.

THE TLUMIP MODELS

The TLUMIP models are of great interest to the modeling community, planners and policy makers both within Oregon and throughout the world. These modeling advances and their ability to study transportation-land use-economic relationships and related policy questions are unique.

The TLUMIP models simulate land use and travel behavior mathematically and rely on various data, from business sector exports to transportation operator characteristics. The models are a valuable complement to more traditional urban and MPO travel demand models.

The first phase of TLUMIP developed a set of prototypical integrated land use-transportation models at the statewide, substate, and metropolitan levels. The Oregon1 statewide model was implemented and calibrated using a customized TRANUS framework. A new urban model known as UrbanSim was also developed. It is a dynamic microsimulation model of land use suitable for use in urban places.



This figure represents the complexity of the interactions and the interdependence of economics, land use and transportation embodied in the TLUMIP models.

The statewide model starts with an input-output economic model of commodities by standard industrial code in dollars. The amounts correspond to the production and consumption of goods and services and trading relationships between sectors of the economy in the study

area. As the model distributes these goods and services regionally, each industry locates on available land that is accessible to both production (business) and consumption (business and households) markets. This is the spatial activity portion of the model.

Given economic activities and their location within the study area, the model then generates the travel required to support production and consumption of activities. These movements are represented as vehicle and freight trips on the transportation system.

These trips are assigned to travel the system via the most cost-effective (time and distance) path. As the number of vehicles and roadway congestion rises so does the cost of using the roadways. These costs impact the costs of goods and services, which are fed back into the economic model. As a result, in the next time period, businesses may choose to relocate or leave the study area to minimize these costs.

These cost increases are then fed back into the economic model where the model reiterates until there is little change in these costs. The model continues to advance through each time period until it reaches a predetermined forecast year. Policies can be introduced at any point for testing.

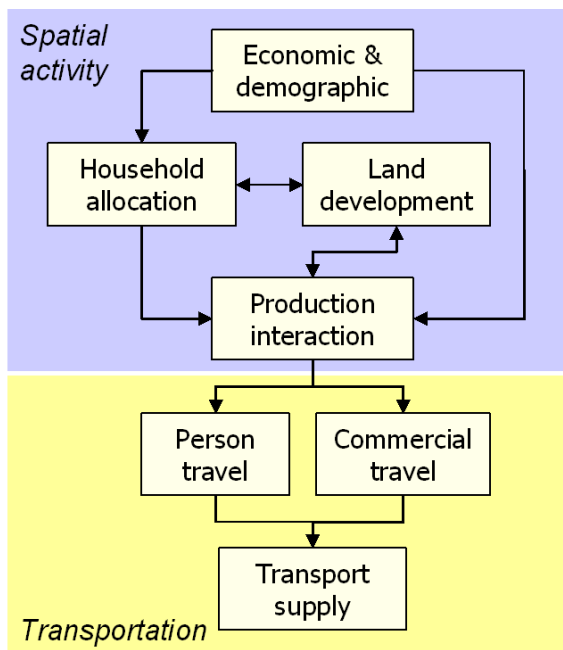
Several policies that have been tested by the Oregon1 statewide model include:

- Evaluated the economic costs of deteriorating Oregon bridges, and generated an economically viable phased bridge rebuilding plan.
- Evaluated the growth and livability impacts of various transport and land use visions for the populous Oregon Willamette Valley.
- Economic and transportation evaluation of a new Interstate highway in rural eastern Oregon.
- Analyzed induced demand from a proposed urban bypass roadway.

THE NEXT GENERATION OF THE TLUMIP PROGRAM

The experience gained with Oregon1 is positive. Oregon's modeling tools engage technical staff and policy-makers in a collaborative and comprehensive approach to define and solve the complex policy issues faced today. Clearly, the integrated models are plausible and can provide policy-makers and planners with timely and useful information about the interactions between the economy, land use, transportation and the environment.

Capitalizing on the promising aspects of the first generation models, Oregon2 is being developed. The principal components are shown below. Modeling requirements were thoroughly reviewed and a new model specification developed. This underwent extensive revision through the peer review process. The resulting design brought the parallel tracks of the first generation model into a single unified development effort.



Oregon2 is near completion and includes several innovative model elements:

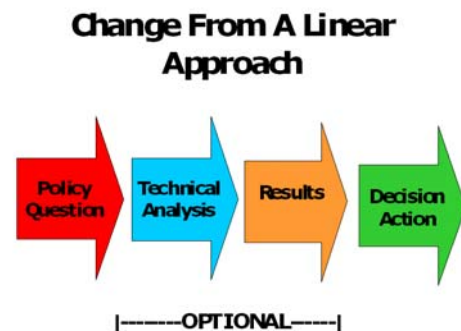
- Operates at varying scales depending on what is being measured, using MPO traffic analysis zones within the urban areas and larger zones outside, aggregated trade regions for the economic model, and land use at a 30-meter grid cell level.
- Fully integrated economic, land use and transportation model elements.
- Fully dynamic.
- Uses hybrid equilibrium (for economic and transportation markets) and disequilibrium (for activity and location markets) formulation.
- Uses activity-based travel models.
- Data required for the model is affordable, both in terms of time and money.

A modular, component-based modeling system using object-oriented programming is under development. Oregon2 models will be developed in an open source environment, enabling others to use and contribute to the development of the software.

TLUMIP models use the strength of geographical information systems (GIS) to analyze land use and transportation data and to display information in easily understood maps and graphics. Models developed at the statewide and urban levels are being integrated to allow analysis of the entire state transportation system in a multi-modal, coordinated, and standardized process.

A NEW WAY OF THINKING AND DECISION-MAKING

TLUMIP modeling tools inform a comprehensive approach to decision-making. Historically, decisions tended to be made in a linear fashion. Technical analysis and recommendations were available but often simply substantiated decisions instead of helping to develop or inform decisions.



Oregon's modeling tools and the OMIP program engage technical staff and policy-makers in a collaborative and holistic approach to define and solve the complex policy issues faced today.

To An Interactive And Iterative Approach



TLUMIP MODEL SUPPORTS \$2.5 BILLION BRIDGE INVESTMENT PROGRAM

A recent application of the Oregon1 model in policy analysis was started in 2002 when ODOT bridge engineers identified structural deficiencies and cracking on over 600 state, city and county bridges. Deterioration, a result of many factors, led to load limiting heavy truck traffic on several bridges. This action impacted freight traffic throughout the state and created safety and liability concerns in towns subject to emergency detours.

The TLUMIP model was used to estimate the impacts to the Oregon economy and jobs that would result from posting bridges to limit trucks of various weights. Looking at different ranges of truck weights helped to define the potential severity of the problem. The model was used with other tools to develop a staging plan to identify the roadway corridors to improve and when.

A multi-disciplinary and multi-agency peer review team of staff and consultants was assembled to review model assumptions and results. Especially important was the technical review of economic assumptions, and interpretation and validation of the model results.

The model results provided information on the potential severity of various investment options, including no new funding. The model highlighted the regional impacts of load limiting bridges in the more rural and economically depressed parts of the state that rely on heavy truck businesses, such as gravel, agriculture and forestry.

Informing decision-makers of the economic and livability trade-offs of various options was key to understanding the issue and the ultimate success of the legislative funding package. The economic and job impact model results were the headline used by ODOT to secure a \$2.5 billion transportation finance package in the 2003 Legislature.

Another significant result of the modeling effort is that ODOT bridge improvement prioritization will begin to consider more elements than simply the structural condition of the individual bridge. A "network vision" approach recognizes that fixing one bridge within a detour segment is useless unless all bridges in that segment can carry the loads.

Continued model applications will include use of the statewide model to help balance priorities for bridge investments as well as other state and regional highway improvements. It will also be used to establish and monitor performance measures, responding to legislative requests for regular reports on results of bridge and road investments on job creation and the Oregon economy.

A copy of the full Economic & Bridge Options Report is available on the ODOT website at <http://www.odot.state.or.us/tddtpau/modeling.html>.

COOPERATION IS KEY TO A SUCCESSFUL PROGRAM

The success of TLUMIP and the Oregon modeling program is attributable to an uncommon level of collaboration and cooperation. Three groups provide regular oversight, review and conversation.

International Peer Review Panel

The peer review panel is a diverse panel of internationally prominent modeling experts in both academia and consulting environments. This panel maintains a key role in the TLUMIP program. It meets regularly to review progress on the models and to recommend improvements and modifications. Their invaluable contributions shaped the TLUMIP work program and heavily influenced the design of the second-generation models.

Oregon Modeling Steering Committee (OMSC)

The OMSC directs travel modeling in Oregon. This consortium is comprised of representatives of local, state, and federal agencies and all MPOs. Membership includes the key state agencies responsible for land use, transportation, economic and environmental policy development and implementation. These include:

- Governor's Community Solutions Office
- Office of Economic Analysis
- Economic & Community Development Dept.
- Environmental Quality Dept.
- Housing & Community Services Dept.
- Land Conservation & Development Dept.
- Department of Transportation

FHWA and all Oregon MPOs have been partners in the program since its inception. The Vancouver, Washington MPO is a member because of mutual issues between Vancouver and Portland. The Port of

Portland is a member because of its significant role in freight planning issues.

OMSC members regularly serve on peer review teams for model development and applications throughout Oregon. These teams are directed by OMSC members but include consultants and others as appropriate, to ensure the full range of technical expertise and capabilities to address the issue at hand.

Statewide Users Group

An OMIP statewide users group includes technical staff from local and state agencies and jurisdictions, consultants, and others involved in the day-to-day application of modeling tools. This group of practitioners meets regularly to exchange knowledge and information, solve problems, and provide training.

MUCH WAS LEARNED IN DEVELOPMENT AND APPLICATION OF THE TLUMIP MODEL

Data, Data, and More Data. As expected, availability, accuracy and completeness of data was a challenge to the program. When data were available, they were not always accurate, did not contain exactly the information needed, or were inconsistent from one county to the next.

An important step of OMIP was to standardize data collection and analysis under the auspices of the OMSC. The 1994 household activity and travel survey was a cooperative research project sponsored by ODOT, the five Oregon MPOs, and SW Washington. This resulted in a rich database of activity and travel information for almost 12,000 households across the state.

Similarly, ODOT and the MPOs jointly estimated a travel demand model for all areas within Oregon. This common model structure brings modeling best practices to all areas of the state and reinforces standardized and cooperative data collection and analysis.

ODOT has also partnered with the Port of Portland and Portland Metro to develop a coordinated freight data collection strategy that has resulted in data useful by all three agencies.

It's All About the Economy. Although economics was part of the model development effort, TLUMIP initially focused on the interactions of land use and transportation. In application, however, land use did not necessarily inform on transportation or economic results but rather became an intermediary that related transportation and the economy. The economic effects illuminated what happens with land use under different transport strategies, and land use became a by-product of economic interaction.

In the Oregon bridge study, for example, the modeling objective was to show the economic effects of various bridge investment options. Land use outcomes were important to show the impacts of different funding scenarios on regional growth patterns. However, economic information was of most interest to legislators as they debated different funding strategies based on localized economic impacts. Oregon2 will place more emphasis on economics.

The Model Should Help Define the Question, Not Just Validate the Answer. The model should be used to develop options, not support preconceived solutions. It will take time and many applications before this new way of thinking about complex issues and proper use of the new modeling tools become the way of doing business within Oregon. Interest and support from outside agencies and special interest groups is helpful. Building trust, relationships and understanding of the model early in the study process is very important.

Credibility and Visualization are Key. The credibility of the model and modeling results is critical. Good interpretation and presentation of model results are also very important. It is challenging to balance the time required for model runs and interpreting results with the needs and expectations of decision-makers for fast turnaround.

It is also challenging to identify, develop and display meaningful performance measures. Visual results are critical but difficult to develop. Model results are presented in a variety of ways – bulleted text, maps, bar charts and other graphics – to be useful to the varied audiences that use the model information.

THANKS

The TLUMIP program has been successful due to the dedication and hard work of a variety of people. In addition to the groups mentioned previously, several consultants have been instrumental in development and implementation of TLUMIP: Parsons Brinckerhoff, ECONorthwest, HBA Spectro, and MW Consulting.

FOR MORE INFORMATION

Visit the ODOT website for more information on TLUMIP and OMIP at <http://www.odot.state.or.us/tddtpau/modeling>, or contact:

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